Comprehensive Evaluation and Transition of Non-Chromate Primers within DoD

WP-201132

Julia Russell,
Materials Engineering Division

ASETS Defense 2012

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Comprehensive Evaluation and Transition of Non-Chromate Primers within DoD	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **NavalAir Warfare Center, Patuxent River,MD, 20670**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the ASETSDefense 2012: Workshop on Sustainable Surface Engineering for Aerospace and Defense August 27-30, 2012, San Diego, CA

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**14**	

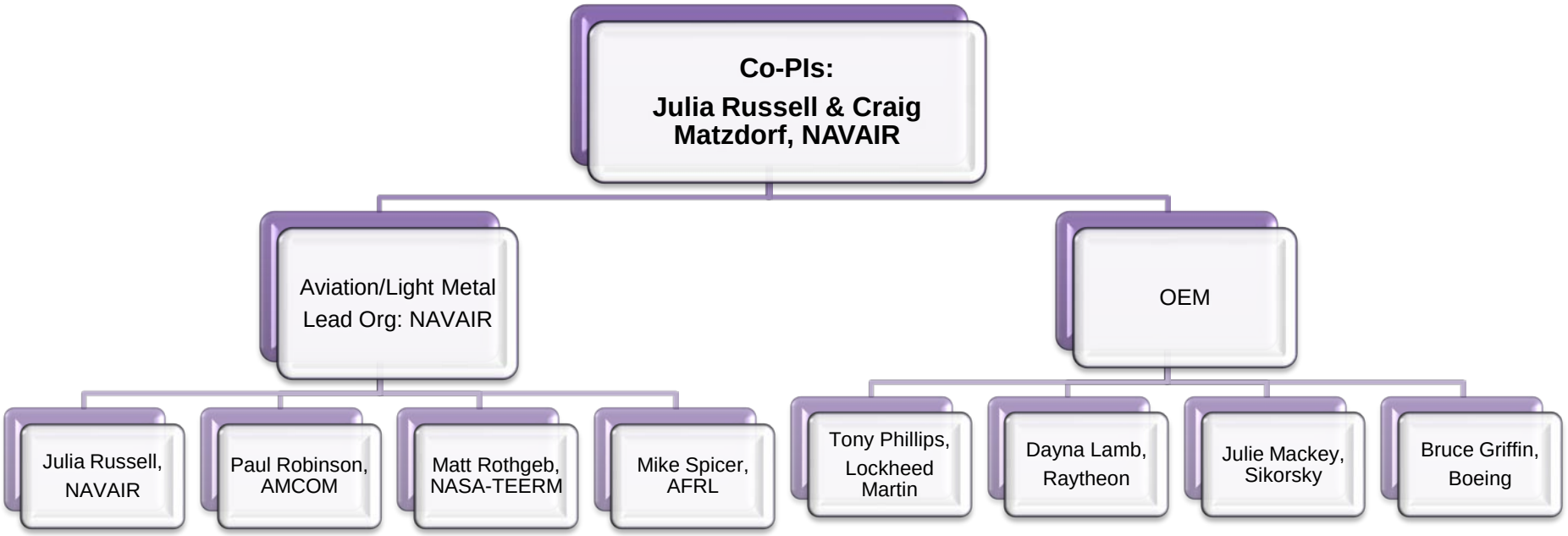
Overview

- Purpose
- Project Team
- On-going efforts (Lab Validation)
- Demos
- Implementation
- Questions?

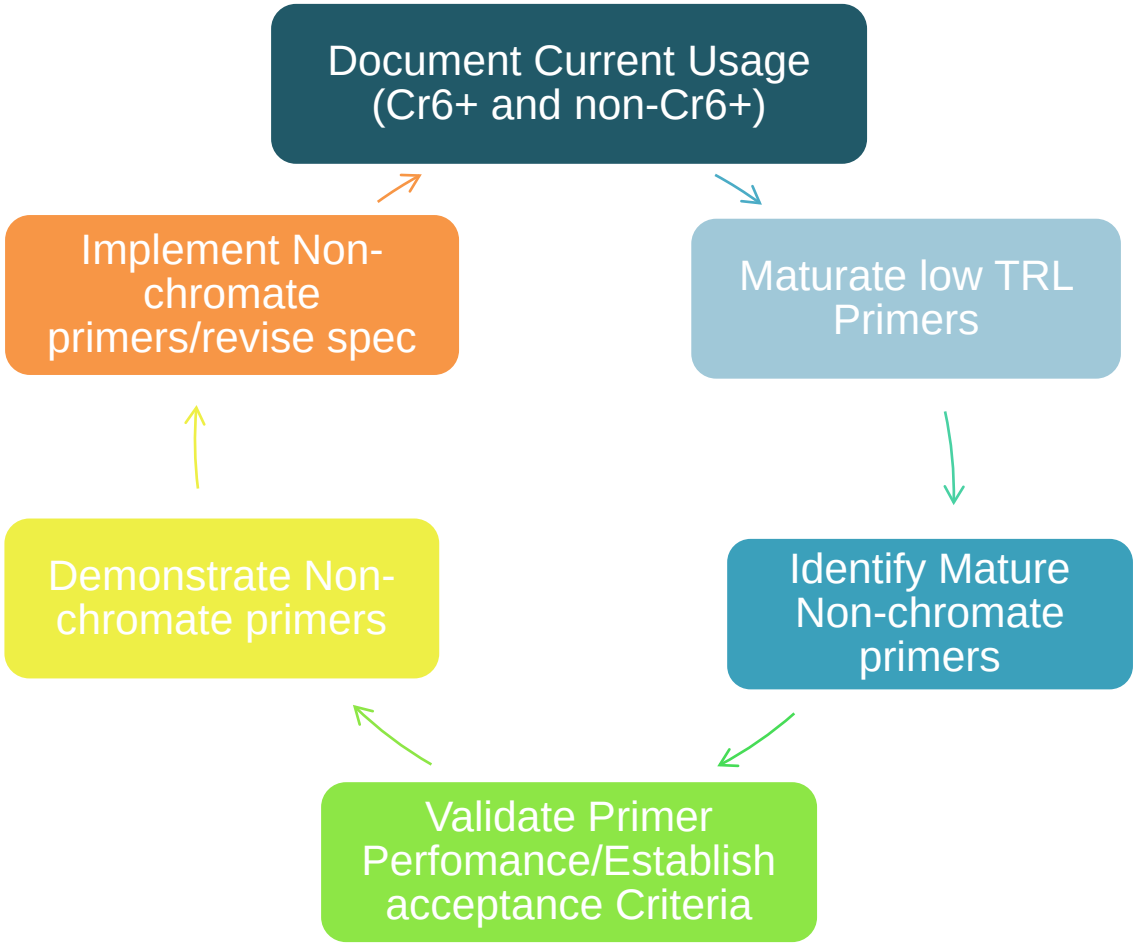
Objective/Purpose

- **GOAL**
  - *"Top down" assessment of current NC primer technology, including coating process MRL and coating TRL*
  - *Dem/val NC primers and processes with sufficient process and coating maturity and invest in development of promising newer technologies*
- Test multiple substrates, surface conditions, exposure environments and coating combinations, comparing to CCC
- Joint service demonstration (Army, AF, USCG, USMC)
- Leveraged with NESDI Project #458 – focused on NAVAIR dem/vals

Project Team



Technical Objective



Technical Approach

Minimize Current Usage by identifying and filling gaps

“Top-down” vs. “bottoms up” assessment of Non-chromate primers

Develop DoD/service testing guidelines

Maturate lower TRL primers

Modify primer specifications to account for improved testing procedures/new types of primers

Primer validation

- AF/NAVAIR
  - Mg Oxide Corrosion performance (Phase I – **on going**)
  - Skydrol Resistance (Phase II – **planning**)
- AMCOM
  - Mixed Metal (depot-level rework) metal-rich primer evaluation
- Crosslink Primer Development

US Navy P-8A & USAF KC-46

- BCA switched to non-chromate coating system for 737, 747, 767, 777 production lines:

Sol-gel & PPG CA7502

USN P-8A to replace P-3C

New coating system – Risk Item for PO

USAF KC-46A to replace KC-135

***BCA agreed to keep chromate primer on OML of EMD a/c**

NAVAIR/USAF Statement of Need

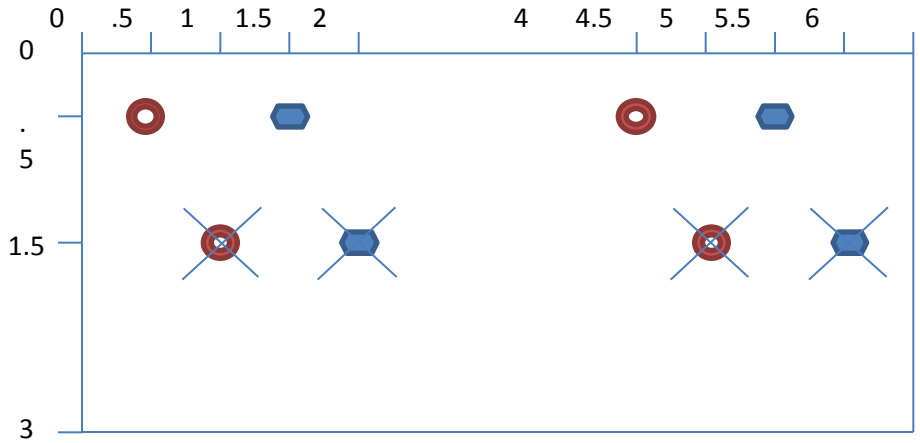
- Solgel/CA7502 Coating system requires the use of acid-activated strippers
  - Banned use of acid-activated strippers in USN & USAF

- Compare PPG CA7502 to other Mg Oxide primer formulations and a chromate control.

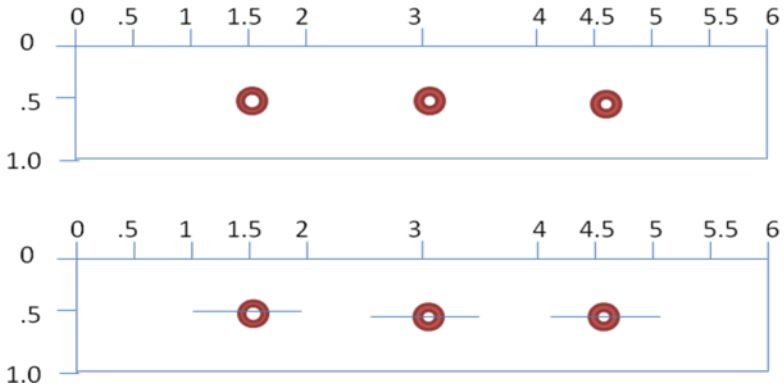
	Flat Panels (3"x5" or 6"x0.032")	**NAVAIR Galvanic (3"x6"x0.25")**	**AF Galvanic**
Substrates:	AA2024-T3 AA7075-T6 Clad AA2024- T3	AA2024-T3 AA7075-T6	AA2024-T3 AA7075-T6
Pretreatments:	Boegel EAP9 Alodine 1600		
Primers :	Akzo Nobel MgO 2111 PPG CA 7236 PPG CA 7211 PPG CA 7222 *PPG CA 7233*		
Topcoat	Deft ELT		
Corrosion tests:	ASTM B117 (x2) ASTM G85 A4	ASTM B117 ASTM G85 A4 Beachfront	ASTM B117 ASTM G85 A4 Beachfront

NAVAIR/USAF Statement of Need

- Compare & correlate NAVAIR and AFRL galvanic panel test methods



NAVAIR Galvanic Assembly

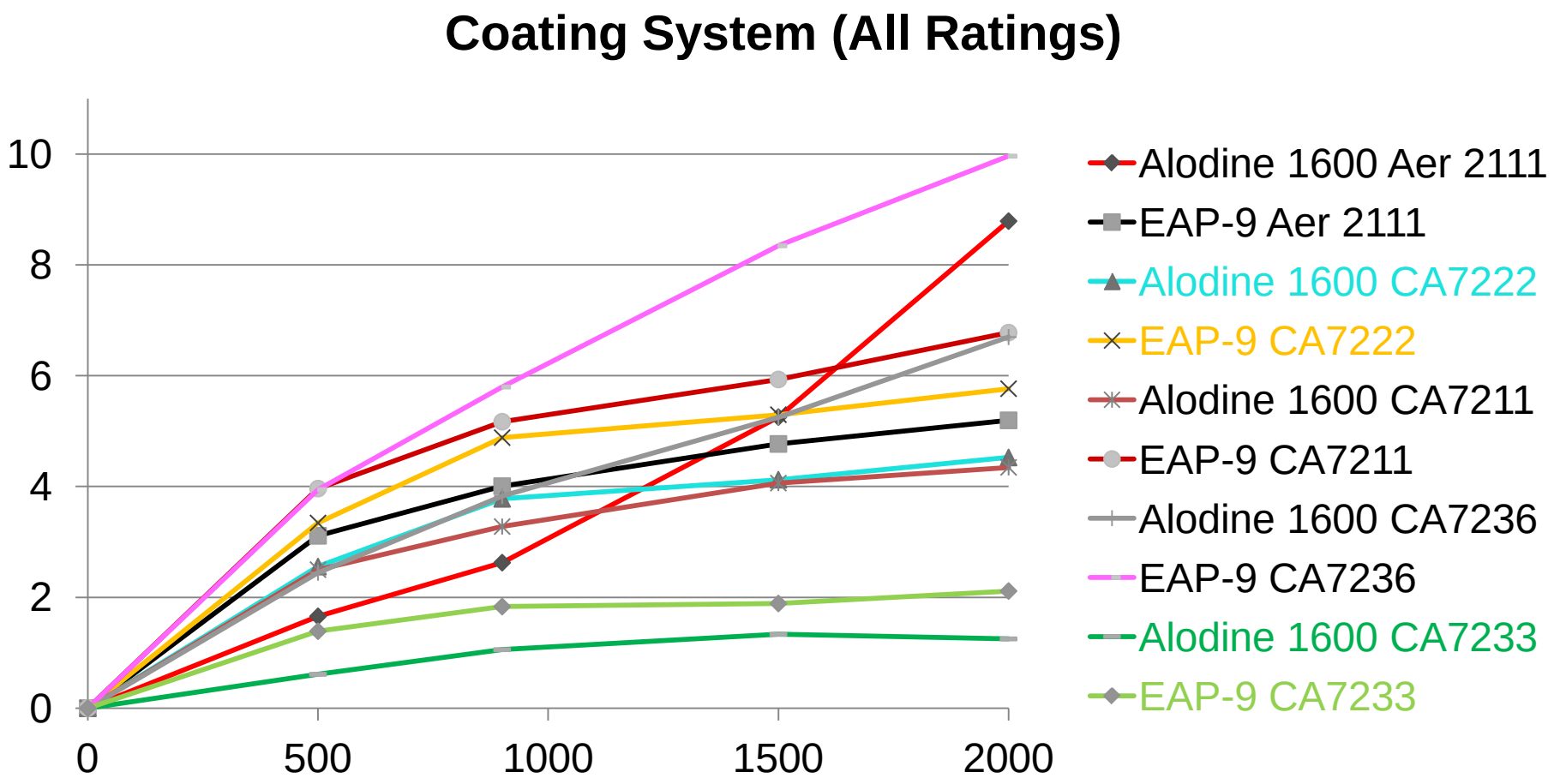


USAF Galvanic Assembly

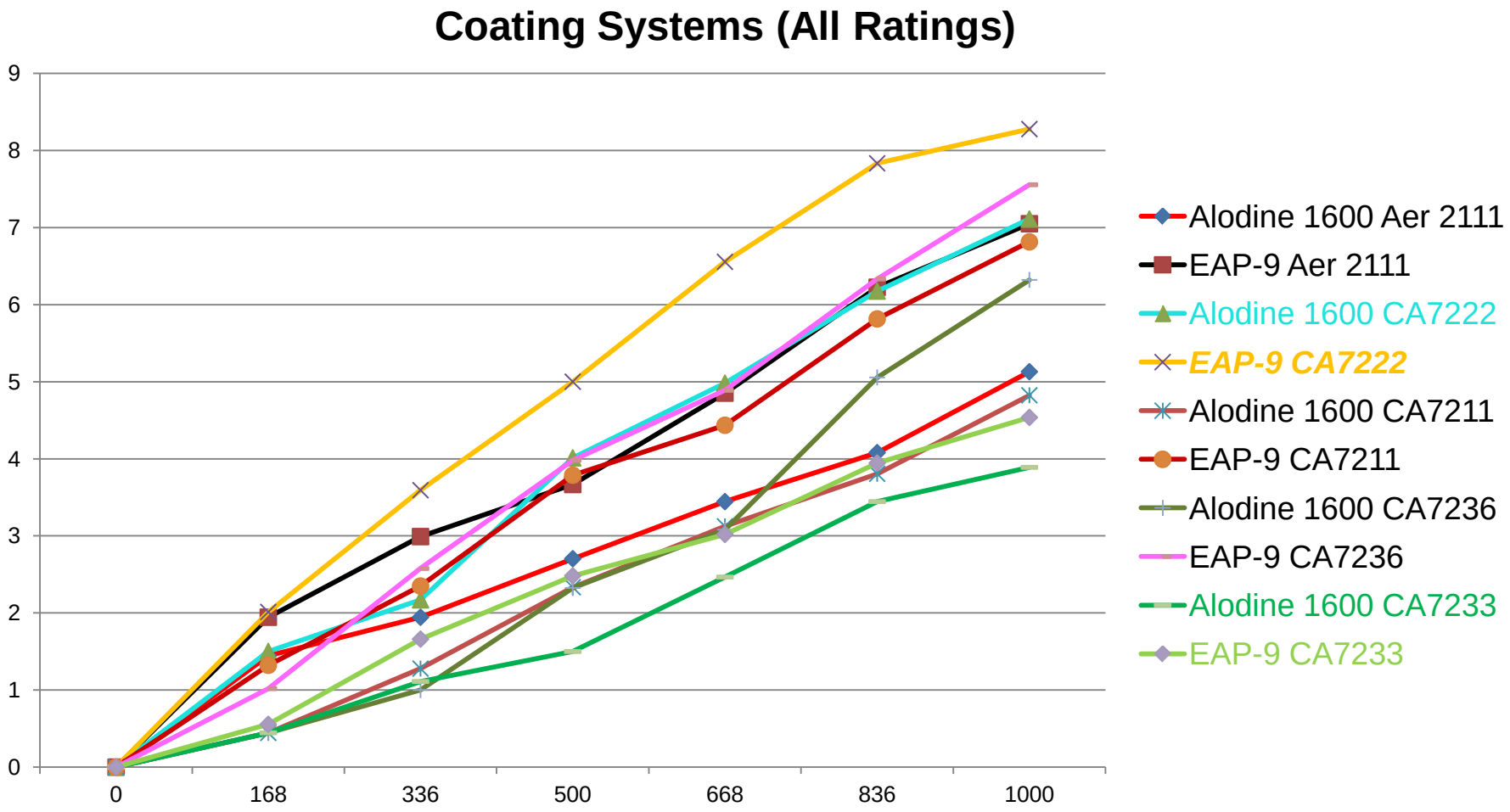
NAVAIR/USAF Testing to date

- Flat panel evaluation
  - ASTM B117: Complete (2000 hrs)
  - ASTM G85.A4: Complete (1000 hrs)
- Galvanic Panel evaluation
  - ASTM B117: Complete (???)
  - ASTM G85.A4: Complete (336 hrs NAVAIR; 500 hrs USAF)
  - Beachfront: on-going

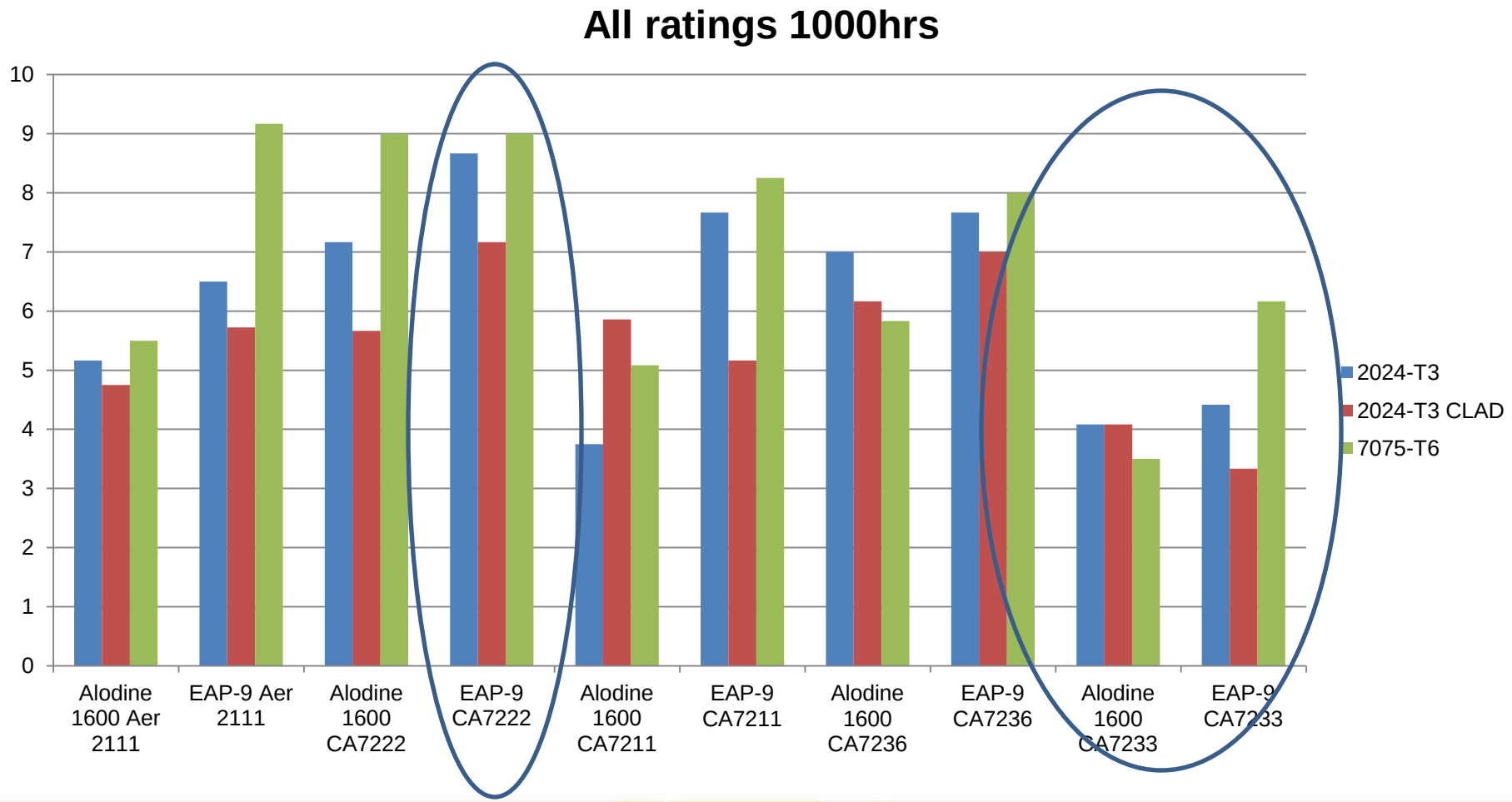
Flat Panels ASTM B117 2000 hrs



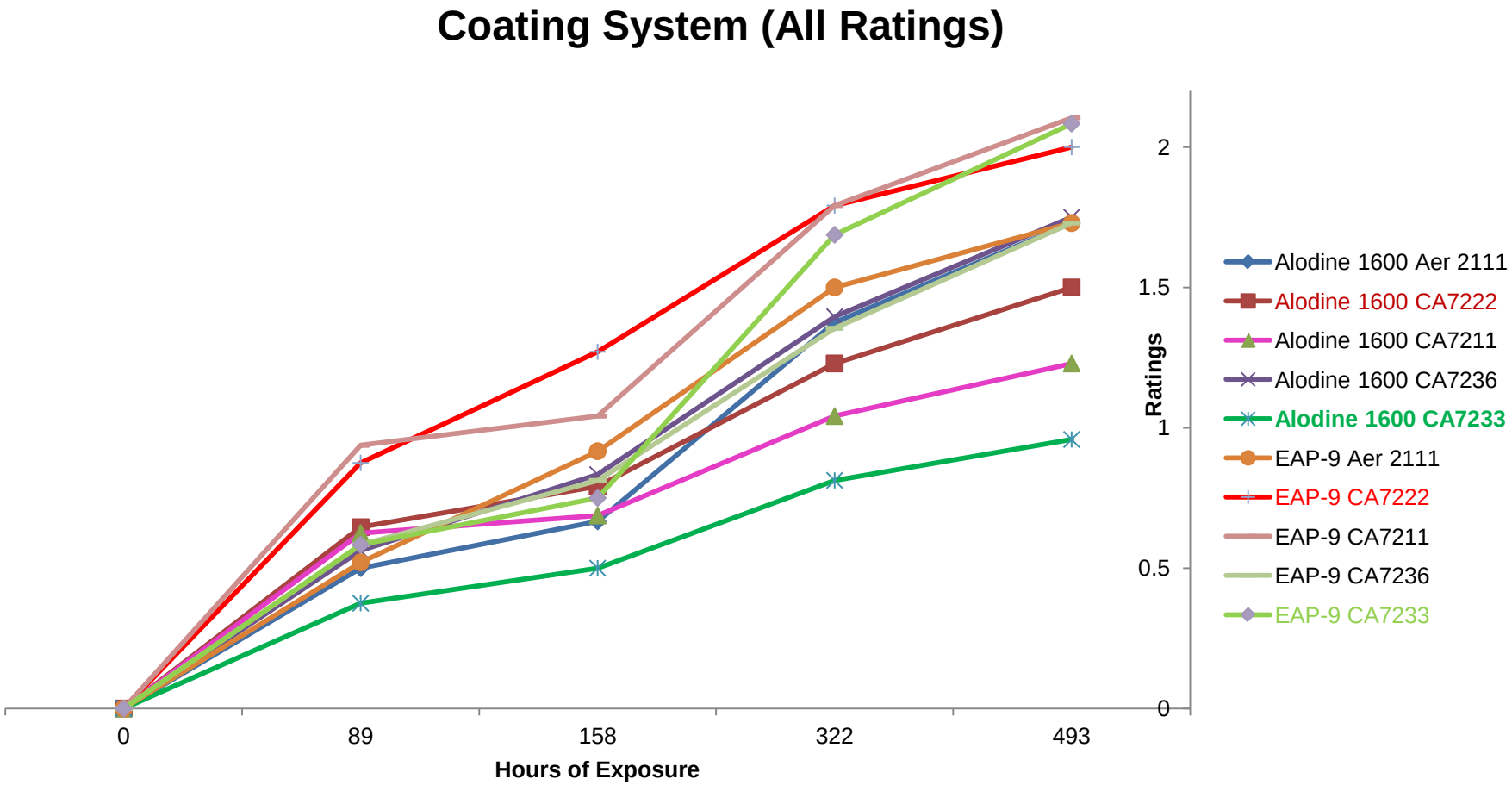
Flat Panels ASTM G85.A4 1000 hrs



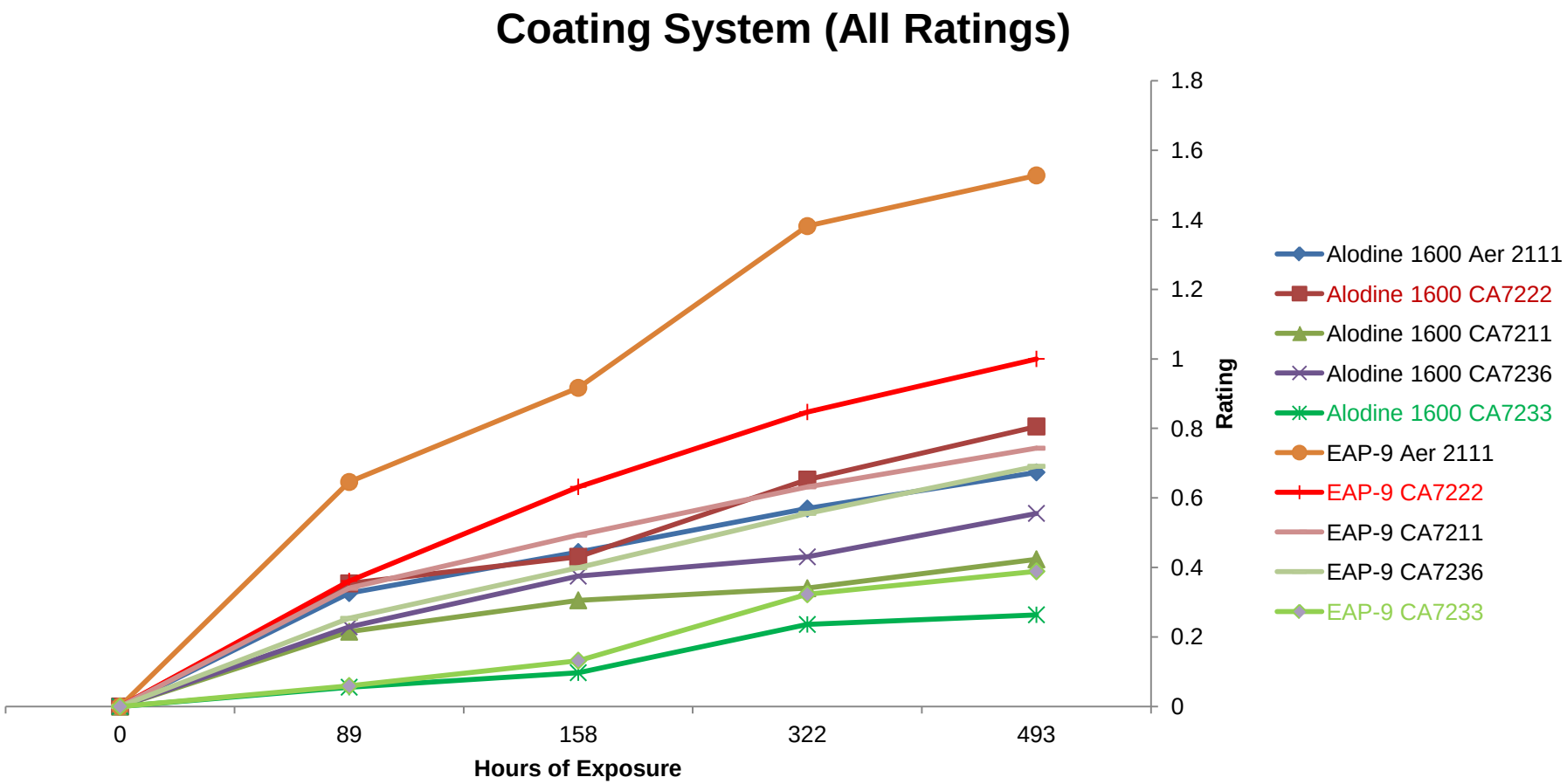
Flat Panels ASTM G85.A4 1000 hrs



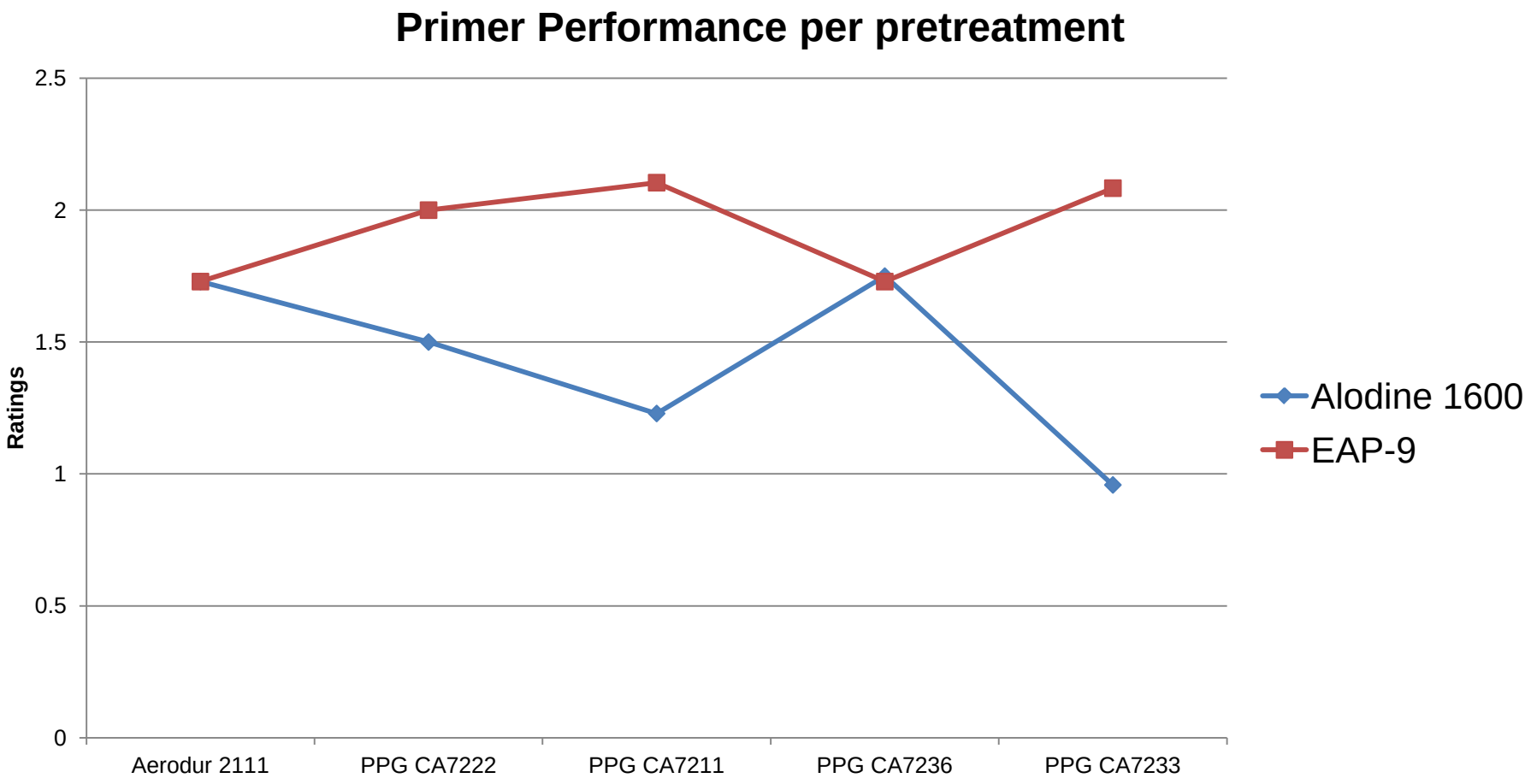
Galvanic Assemblies: ASTM B117-NAVAIR



Galvanic Assemblies: ASTM B117 - USAF



Galvanic Assemblies: ASTM B117-NAVAIR



US Army (GSE & Aviation)

- During Depot re-work, systems may not be completely disassembled resulting in components that are comprised of “mixed” materials
  - aluminum-aluminum
  - aluminum-steel
  - aluminum-composite
- Components are then reassembled into the finished item and preserved with the CARC system coating “stack up”.

Mixed Metal – Test Plan

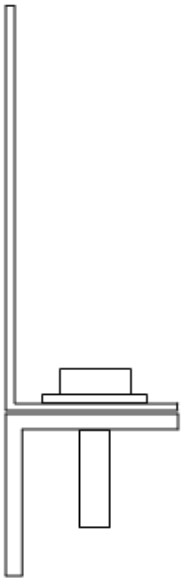
Steel and Aluminum mixed structures Corrosion and Galvanic Tests

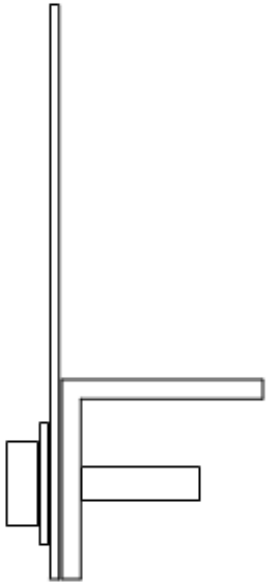
Coating System Component	Control	Alternate 1	Alternate 2
Pretreatment	DoD-P-15328	MIL-DTL-81706 Type II (TCP)	
Primer	MIL-DTL-53022 Ty II		
Alt Primer 1	N/A	Mg-Rich	Magoxide
CARC Top Coat	MIL-DTL-53039 Type IV or IX		

Al / Al, and Al / Composite mixed Structures Test Coatings for Corrosion and Galvanic Tests

Coating System Component	Control	Alternate 1	Alternate 2
Pretreatment	MIL-DTL-81706 Type II (TCP)		
Primer	MIL-PRF-23377 Type I Class N		
Alt Primer	N/A	Mg-Rich	Magoxide
Top Coating	MIL-DTL-53039 Type IV or IX		

Mixed Metal:
Galvanic Specimen Configuration





(LEFT) Configuration of the Aluminum-Steel and Aluminum-Aluminum test coupons.
Joint between the steel and aluminum components will be faced sealed with SAE-AMS-S-8802 along with bolt heads and nuts.

(RIGHT) Configuration of the Aluminum-Composite test coupons
Joint between the aluminum and composite components will be faced sealed with SAE-AMS-S-8802 along with bolt heads and nuts.

Crosslink Primer

- Previously funded through ESTCP Project #WP-200904
- 3-component primer based on promising new NC pigment package
- Crosslink partnered with Hentzen Coatings, Inc. and Wayne Pigment Corporation to optimize and mature primer formulation
- Hentzen/Crosslink evaluating mature formulas in-house prior to sending to NAVAIR

On-going Demos

Implementation

USN/USMC V22 ~
Hentzen 17176KEP

USN trainers~
Deft 02GN084

Sikorsky H-60 ~
Deft 02GN084

Lockheed Martin F-35~
Deft 44GN098

Questions?